PATENT

IN THE SPECIFICATION

Please amend the paragraphs of the specification as follows:

Please replace Paragraph **[1002]** with the following amended paragraph:

[1002] The use of code division multiple access (CDMA) modulation techniques is one of several techniques for facilitating communications in which a large number of system users are present. Other multiple access communication system techniques, such as time division multiple access (TDMA) and frequency division multiple access (FDMA) are known in the art. However, the spread spectrum modulation techniques of CDMA [[has]] <u>have</u> significant advantages over other modulation techniques for multiple access communication systems. The use of CDMA techniques in a multiple access communication system is disclosed in U.S. Patent No. 4,901,307, entitled "SPREAD SPECTRUM MULTIPLE ACCESS COMMUNICATION SYSTEM USING SATELLITE OR TERRESTRIAL REPEATERS," assigned to the assignee of the present invention and is incorporated by reference herein. The use of CDMA techniques in a multiple access communication system is further disclosed in U.S. Patent No. 5,103,459, entitled "SYSTEM AND METHOD FOR GENERATING SIGNAL WAVEFORMS IN A CDMA CELLULAR TELEPHONE SYSTEM," also assigned to the assignee of the present invention and is incorporated by reference herein. Furthermore, the CDMA system can be designed to conform to the "TIA/EIA/IS-95A Mobile Station-Base Station Compatibility Standard for Dual-Mode Wideband Spread Spectrum Cellular System", hereinafter referred to as the IS-95A standard.

Please replace Paragraph **[1025]** with the following amended paragraph:

[1025] Referring to the figures, FIG. 1 represents an exemplary communication system of the present invention which is composed of multiple base stations [[4]] <u>4a, 4b and 4n</u> in communication with multiple remote stations **6** (only one remote station **6** is shown for simplicity). System controller **2** connects to all base stations **4** in the communication system and

the public switched telephone network (PSTN) **8**. System controller **2** coordinates the communication between users connected to PSTN **8** and users on remote stations **6**. Data transmission from base station **4** to remote station **6** occurs on the forward link through signal paths **10** and transmission from remote station **6** to base station **4** occurs on the reverse link through signal paths **12**. The signal path can be a straight path, such as signal path **10a**, or a reflected path, such as signal path **14**. Reflected path **14** is created when the signal transmitted from base station **4a** is reflected off reflection source **16** and arrives at remote station **6** through a different path than the straight path. Although illustrated as a block in FIG. 1, reflection source **16** is an artifact in the environment in which remote station **6** is operating, e.g. a building or other structures.

Please replace Paragraph **[1026]** with the following amended paragraph:

[1026] An exemplary block diagram of base station **4** and remote station **6** of the present invention is shown in FIG. 2. Data transmission on the forward link originates from data source **120** which provides the data, in data packets, to encoder **122**. An exemplary block diagram of encoder **122** is shown in FIG. 3. Within encoder **122**, CRC encoder **312** block encodes the data with a CRC polynomial which, in the exemplary embodiment, conforms to the IS-95A standard. CRC encoder **312** appends the CRC bits and inserts a set of code tail bits to the data packet. The formatted data packet is provided to convolutional encoder **314** which convolutionally encodes the data and provides the encoded data packet to symbol repeater **316**. Symbol repeater **316** repeats the encoded symbols N_S times to provide a constant symbol rate at the output of symbol repeater **316** regardless of the data rate of the data packet. The repeated data is provided to block interleaver **318** which reorders the symbols and provides the interleaved data to modulator (MOD) **124**. A block diagram of an exemplary modulator **124a** is shown [[if]] <u>in</u> FIG. 3. Within modulator **124a**, the interleaved data is spread by multiplier **330** with the long PN code which identifies the remote station **6** to which the data is transmitted. The long PN spread data is provided to multiplier **332** which covers the data with the Walsh code corresponding to the traffic channel assigned to remote station **6**. The Walsh covered data is further spread with the

short PNI and PNQ codes by multipliers **334a** and **334b**. The short PN spread data is provided to transmitter (TMTR) **126** (see FIG. 2) which filters, modulates, and amplifies the signal. The modulated signal is routed through duplexer **128** and transmitted from antenna **130** on the forward link through signal path **10**.

Please replace Paragraph **[1027]** with the following amended paragraph:

[1027] A block diagram of an alternative modulator **124b** is shown in FIG. 4. In this embodiment, data source **120** provides data packets to two encoders **122** which encode the data as described above. The interleaved data and the pilot and control data are provided modulator **124b**. Within modulator **124b**, the interleaved data from the first encoder **122** is provided to Walsh modulator **420a** and the interleaved data from the second encoder **122** is provided to Walsh modulator **420b**. Within each Walsh modulator [[**420**]] <u>420a and 420b</u>, the data is provided to ~~multiplier~~ <u>multipliers</u> [[**422**]] <u>422a and 422b</u> which covers the data with a Walsh code assigned to that Walsh modulator [[**420**]] <u>420a and 420b</u>. The covered data is provided to gain ~~element~~ <u>elements</u> [[**424**]] <u>424a and 424b</u> which scale[[s]] the data with a scaling factor to obtain the desired amplitude. The scaled data from Walsh modulators **420a** and **420b** are provided to summer **426** which sums the two signals and provides the resultant signal to complex multiplier **430**. The pilot and control data are provided to multiplexer (MUX) **412** which time multiplexes the two data and provides the output to gain element **414**. Gain element **414** scales the data to obtain the desired amplitude and provides the scaled data to complex multiplier **430**.

Please replace Paragraph **[1028]** with the following amended paragraph:

[1028] Within complex multiplier **430**, the data from gain element **414** is provided to multipliers **432a** [[and]] <u>through</u> **432d** and the data from summer **426** is provided to multipliers **432b** and **432c**. Multipliers **432a** and **432b** spread the data with the spreading sequence from multiplier **440a** and multipliers **432c** and **432d** spread the data with the spreading sequence from multiplier **440b**. The output of multipliers **432a** and **432c** are provided to summer **434a** which

subtracts the output of multiplier **432c** from the output of multiplier **432a** to provide the I channel data. The output of multipliers **432b** and **432d** are provided to summer **434b** which sums the two signals to provide the Q channel data. The spreading sequences from multipliers **440a** and **440b** are obtained by multiplying the PNI and PNQ codes with the long PN code, respectively.

Please replace Paragraph **[1030]** with the following amended paragraph:

[1030] At remote station **6** (see FIG. 2), the forward link signal is received by antenna **202**, routed through duplexer **204**, and provided to receiver (RCVR) **206**. Receiver **206** filters, amplifies, demodulates, and quantizes the signal to obtain the digitized I and Q baseband signals. The baseband signals are provided to demodulator (DEMOD) **208**. Demodulator **208** despreads the baseband signals with the short PNI and PNQ codes, decovers the despread data with the Walsh code identical to the Walsh code used at base station **4**, despreads the Walsh decovered data with the long PN code, and provides the demodulated data to decoder **210** <u>and control processor 220</u>.

Please replace Paragraph **[1032]** with the following amended paragraph:

[1032] Data transmission from remote station **6** to base station **4** on the reverse link can occur in one of several embodiments. In the first embodiment, the reverse link transmission can occur over multiple orthogonal code channels similar to the structure used for the forward link. The exemplary embodiment of a remote transmission system which supports multiple code channels on the reverse link is described in detail in U.S. Patent No. 5,930,230, entitled "HIGH DATA RATE CDMA WIRELESS COMMUNICATION SYSTEM", assigned to the assignee of the present invention and incorporated by reference herein. A simplified block diagram of the structure is shown in FIG. 9. Data source **230** provides the data, in data packets, through DEMUX **912** to channel encoders [[**910**]] <u>910a - 910n</u>. Within each channel encoder [[**910**]] <u>910a – 910n</u>, CRC encoder **914** block encodes the data packet then appends the CRC bits and a set of code tail bits to the data. The formatted data packet is provided to convolutional encoder **916** which convolutionally encodes the data and provides the encoded data packet to symbol

repeater **918**. Symbol repeater **918** repeats the symbols with the encoded data packet N_S times to provide a constant symbol rate at the output of symbol repeater **918** regardless of the data rate. The repeated data is provided to block interleaver **920** which reorders the symbols within the repeated data and provides the interleaved data to modulator (MOD) **234**.

Please replace Paragraph [1033] with the following amended paragraph:

[1033] Within modulator **234**, the interleaved data from each channel encoder [[**910**]] 910a – 910n is provided to a Walsh modulator [[**930**]] 930a – 930n. Within Walsh ~~modulator~~ modulators [[**930**]] 930a – 930n, the interleaved data is covered by multiplier **932** with the Walsh code which identifies the code channel of the set of code channels transmitted by the remote station on which the data is transmitted. The Walsh covered data is provided to gain adjust **934** which amplifies the data with the desired gain setting for the code channel. The outputs from Walsh modulators **930** are provided to complex PN spreader **940** which spreads the Walsh covered data with the long PN code and the short PN codes. The modulated data is provided to transmitter **236** (see FIG. 2) which filters, modulates, and amplifies the signal. The modulated signal is routed through duplexer **204** and transmitted from antenna **202** on the reverse link through signal path **12**. A more detailed description of the reverse link architecture can be obtained from the aforementioned U.S. Patent No. 5,930,230.

Please replace Paragraph [1036] with the following amended paragraph:

[1036] An exemplary block diagram illustrating the circuit for demodulating the received signal is shown in FIG. 6. The digitized I and Q baseband signals from receiver **150** or **206** are provided to a bank of correlators [[**610**]] 610a - 610n. Each correlator [[**610**]] 610a - 610n can be assigned to a different signal path from the same source device or a different transmission from a different source device. Within each assigned correlator [[**610**]] 610a - 610n, the baseband signals are despread with the short PNI and PNQ codes by multipliers [[**620**]] 620a – 620n. The short PNI and PNQ codes within each correlator [[**610**]] 610a - 610n can have a unique offset corresponding to the propagation delay experienced by the signal being demodulated by that

correlator [[610]] 610a - 610n. The short PN despread data is decovered by multipliers [[622]] 622a and 622b with the Walsh code assigned to the traffic channel being received by the correlator [[610]] 610a - 610n. The decovered data is provided to filters [[624]] 624a and 624b which accumulate the energy of the decovered data over a Walsh symbol period.

Please replace Paragraph **[1037]** with the following amended paragraph:

[1037] The short PN despread data from multipliers [[620]] 620a and 622b also contains the pilot signal. In the exemplary embodiment, at the source device, the pilot signal is covered with the all zero sequence corresponding to Walsh code 0. In the alternative embodiment, the pilot signal is covered with an orthogonal pilot sequence as described in U.S. Patent No. 6,285,655, entitled "METHOD AND APPARATUS FOR PROVIDING ORTHOGONAL SPOT BEAMS, SECTORS, AND PICOCELLS", assigned to the assignee of the present invention and incorporated by reference herein. The short PN despread data is provided to pilot ~~correlator~~ correlators [[626]] **626a and 626b** which perform pilot decovering, symbol accumulation, and lowpass filtering of the despread data to remove the signals from other orthogonal channels (e.g. the traffic channels, paging channels, access channels, and power control channel) transmitted by the source device. If the pilot is covered with Walsh code 0, no Walsh decovering is necessary to obtain the pilot signal.

Please replace Paragraph **[1038]** with the following amended paragraph:

[1038] A block diagram of an exemplary pilot correlator **626** is shown in FIG. 7. The despread data from ~~multiplier~~ multipliers [[620]] 620a and 620b is provided to multiplier **712** which decovers the despread data with the pilot Walsh sequence. In the exemplary embodiment, the pilot Walsh sequence corresponds to Walsh code 0. However, other orthogonal sequences and be utilized and are within the scope of the present invention. The decovered data is provided to symbol accumulator **714**. In the exemplary embodiment, symbol accumulator **714** accumulates the decovered symbols over the length of the pilot Walsh sequence which, for IS-95 Walsh sequence, is 64 chips in duration. The accumulated data is provided to lowpass filter **716** which filters the data to remove noise. The output from lowpass filter **716** comprises the pilot signal.

Please replace Paragraph **[1040]** with the following amended paragraph:

[1040] The pilot signal from each correlator [[**610**]] <u>610a and 620b</u> reflects the signal strength of the signal path received by that correlator [[**610**]] <u>610a and 610b</u>. Dot product circuit **630** multiplies the amplitude of the vector corresponding to the filtered data symbols, the amplitude of the vector corresponding to the filtered pilot signal, and the cosine of the angle between the vectors. Thus, the output from dot product circuit **630** corresponds to the energy of the received data symbol. The cosine of the angle between the vectors (e.g., the angle of the pilot minus the angle of the traffic) weighs the output in accordance with the noise in both pilot and traffic vectors.

Please replace Paragraph **[1041]** with the following amended paragraph:

[1041] Combiner **640** receives the scalar values from each correlator [[**610**]] <u>610a and 610b</u> which has been assigned to a signal path and combines the scalar values. In the exemplary embodiment, combiner **640** coherently combines the scalar values for each received symbol. An exemplary embodiment of combiner **640** is described in detail in U.S. Patent No. 5,109,390, entitled "DIVERSITY RECEIVER IN A CDMA CELLULAR TELEPHONE SYSTEM," assigned to the assignee of the present invention and incorporated by reference herein. Coherent combination takes into account the sign of the scalar output from each correlator [[**610**]] <u>610a and 610b</u> and results in the maximal ratio combining of the received symbols from different signal paths. The combined scalar value from combiner **640** is represented as an m-bit soft decision value for subsequent demodulation and decoding. The soft decision values are provided to multiplier **642** which despreads the soft decision values with the long PN code to produce the demodulated data. The demodulated data is decoded in the manner described above.

Please replace Paragraph **[1048]** with the following amended paragraph:

[1048] A block diagram of an exemplary convolutional encoder **314** of the present invention is shown in FIG. 5. In the exemplary embodiment, convolutional encoder **314** is a constraint length K=9 encoder, although other constraint lengths can also be utilized. The input bits are provided to (K-1) delay elements [[**512**]] 512a – 512h. The outputs from selected delay elements [[**512**]] 512a – 512h are provided to a set of summers [[**514**]] 514a – 514d which perform modulo two addition of the inputs to provide the generator output. For each summer [[**514**]] 514a – 514d, the delay elements [[**512**]] 512a – 512h are selected based on a polynomial which is carefully chosen for high performance.

Please replace Paragraph **[1064]** with the following amended paragraph:

[1064] In the exemplary embodiment, the energy accumulation is performed on a symbol by symbol basis. For each symbol, the combined scalar value (from combiner **640**) of the retransmitted symbol is coherently combined with the scalar value which has been accumulated for this data symbol. The accumulation can be accomplished with an arithmetic logic unit (ALU), a microprocessor, a digital signal processor (DSP), or other devices programmed or designed to perform the functions disclosed herein. Again, coherently combining takes into account the sign of the scalar value. Coherent combination performs the maximal ratio combining of the signals received from the transmission and retransmissions. In this regard, the retransmissions can be viewed as the outputs from additional fingers (or correlators [[**610**]] 610a-610m) of a rake receiver. The retransmissions also provide time diversity for the data transmission.

Please replace Paragraph **[1068]** with the following amended paragraph:

[1068] In a system architecture wherein the pilot signal is not transmitted concurrently with the data transmission, the combination of the data symbols from the transmission and retransmissions is accomplished by another embodiment. An example of such architecture is the reverse link implementation which conforms to the IS-95A standard. It is preferable to accumulated the scalar values according to the signal-to-noise ratio (S/N) of the received signals.

At the destination device, the energy S of the desired signal (e.g. the retransmitted packet) can be computed after the despreading with the long PN code and the short PN codes. The total energy of the received signal can be computed and represented as $\sqrt{S^2+N^2}$. Since the received signal is predominantly comprised of the interference (e.g. N>>S), N is approximately equal to $\sqrt{S^2+N^2}$. Thus, the destination device accumulates the scalar values from the transmission and retransmissions according to the equation:

$$y_i = \sum \frac{\bar{s}_{ij}}{|N_{ij}|} \approx \sum \frac{|\bar{s}_{ij}|}{\left(\sqrt{S^2+N^2}\right)_j}, \tag{1}$$

where y_i is the accumulated scalar value for the i^{th} symbol, $\bar{s}_{ij}$ is the vector of the desired signal for the i^{th} symbols of the j^{th} transmission, $|\bar{s}_{ij}|$ is the scalar value from filter [[624]] <u>624a or 624b</u> for the i^{th} symbols of the j^{th} transmission, and $\left(\sqrt{S^2+N^2}\right)_j$ is the total energy of the received signal for the j^{th} transmission. $\bar{s}_{ij}$ can be approximated with the scalar value $|\bar{s}_{ij}|$ from filter [[624]] <u>624a or 624b</u>. Also, $\sqrt{S^2+N^2}$ can be measured for each data transmission or retransmission. From equation (1) the scalar value of each symbol in the packet is scaled by the gain G=$\left(\sqrt{S^2+N^2}\right)_j$ before accumulation.